

UTILITY  
PATENT APPLICATION  
TRANSMITTAL

Attorney Docket No. P99,2275

First Named Inventor or Application Identifier

Brown et al.

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Only for new nonprovisional applications under 37 CFR 1.53(b))

ADDRESS TO: Assistant Commissioner for Patents  
Box Patent Application  
Washington, DC 20231

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

1. ☒ Specification Total Pages 25
2. ☒ Drawing(s) (35USC 113) Total Pages 8
3. ☒ Declaration and Power of Attorney Total Pages 3
  - a. ☐ Newly executed(original or copy)
  - b. ☐ Copy from prior application (37CFR 1.63(d))  
(for continuation/divisional with Box 14 completed)  
[Note Box 4 Below]
    - i. ☐ **DELETION OF INVENTOR(S)**  
Signed statement attached deleting  
Inventor(s) named in the prior application,  
see 37 CFR 1.63(d)(2) and 1.33(b).
4. ☐ Incorporation By Reference (usable if Box 3b is checked)  
The entire disclosure of the prior application, from which a  
copy of the oath or declaration is supplied under Box 3b,  
is considered as being part of the disclosure of the  
accompanying application and is hereby incorporated by  
reference therein.

ACCOMPANYING APPLICATION PART

5. ☐ Assignment Papers (cover sheet & documentation)
6. ☒ Letter under 37 CFR 1.41(c).
7. ☐ English Translation Document (if applicable)
8. ☐ Information Disclosure Statement (IDS)/PTO-1449 ☐ Copies of IDS Citations
9. ☐ Preliminary Amendment
10. ☒ Return Receipt Postcard (MPEP 503)  
(Should be specifically itemized)
11. ☐ Small Entity ☐ Statement filed in prior application,  
Statement(s) Status still proper and desired
12. ☐ Certified Copy of Priority Document(s)
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14. If a CONTINUING APPLICATION, check appropriate box and supply the requisite information:

☐ Continuation ☐ Divisional ☐ Continuation-in-part (CIP) ☐ of prior application No: \_\_\_\_\_/\_\_\_\_\_

CLAIMS AS FILED

(1) FOR	(2) NUMBER FILED	(3) NUMBER EXTRA	(4) RATE	(5) BASIC FEE \$760.00
TOTAL CLAIMS 20	27	7	\$18.00	\$126.00
INDEPENDENT CLAIMS 03	5	2	\$78.00	\$156.00
ANY MULTIPLE DEPENDENT CLAIMS? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO				
TOTAL FILING FEE ->				\$1042.00

☒ The Commissioner is hereby authorized to charge any additional fees which may be required in connection with this application, or credit any overpayment to ACCOUNT NO. 08-2290. A duplicate copy of this sheet is enclosed.

☒ A check in the amount of \$ 1042.00 to cover the filing fee is enclosed.

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DATE: November 3, 1999

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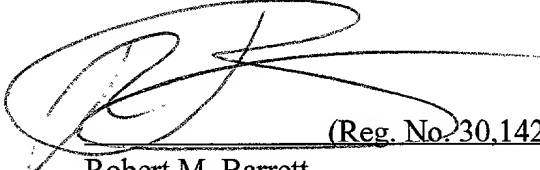
Assistant Commissioner of Patents  
Washington, D.C. 20231

Re: Brown et al. Application for Patent entitled: "FUSE ARRANGEMENTS AND FUSE BOXES FOR A VEHICLE"; Attorney Docket No. P99,2275.

Sir:

Under the provisions of 37 CFR 1.41(c), I am filing the attached patent application, claims, abstract, drawings and declaration and power of attorney on behalf of William P. Brown, James Chen, Carl S. Reid, Demetrios Thanopoulos, and Stephen J. Whitney by Express Mail No. EL 345 371 177 US and request that the patent application be assigned a serial number and filing date pursuant to the provisions of 37 CFR 1.53(b) and 37 CFR 1.53(d).

Respectfully submitted,



(Reg. No. 30,142)

Robert M. Barrett  
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1060/1266  
Enclosure

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT: Brown et al. ATTY. DOCKET NO.: P99,2275  
SERIAL NO: Unknown  
FILED: Herewith  
INVENTION: "FUSE ARRANGEMENTSAND FUSE BOXES FOR A VEHICLE"

Assistant Commissioner for Patents

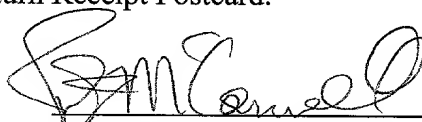
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**CERTIFICATE OF MAILING BY EXPRESS MAIL**

Sir:

I hereby certify that the following documents relating to the above-identified application were deposited in the United States Postal Service Express Mail "Post Office to Addressee" on November 3, 1999:

1. Utility Patent Application Transmittal (in duplicate);
2. Specification (25 pages);
3. Drawings (8 pages);
4. Declaration and Power of Attorney form (3 pages);
5. Letter Under 37 CFR 1.41(c);
6. Check for \$832.00; and
7. Return Receipt Postcard.



Signature of person mailing Express Mail

November 3, 1999

Express Mail Label No. EL 345 371 177 US

63667-0000

**TITLE**

"FUSE ARRANGEMENTS AND FUSE BOXES FOR A VEHICLE"

**BACKGROUND OF THE INVENTION**

5           The present invention relates generally to fuse boxes for vehicle electrical systems. More specifically, the present invention relates to fuse arrangements that can be used in vehicle fuse boxes.

10           Of course, it is known to use fuses in vehicles such as an automobile. Typically, such fuses are located within one or more fuse boxes that are located within the vehicle. The fuse boxes provide a central location for the placement of fuses. Each of the electrical circuits within the vehicle is routed through the fuse box and to  
15           a fuse. This allows the fuses to protect the wiring and the load from harmful overcurrent conditions.

          Referring to Figure 1, a typical fuse box used in an automobile is illustrated. The fuse box 10 is typically constructed of a rigid plastic and includes a  
20           base 12 and a cover 14. The base 12 includes a number of terminals 16 disposed in a bottom portion 18 of the base. These terminals are electrically connected to fuse receptacles 22 on a top portion 20 of the base.

          Each fuse receptacle 22 contains two "female"  
25           apertures 24 that receive corresponding "male" fuse blades 28 of a typical radial-type automotive fuse 26, shown in Figure 2. The particular terminals 16a and 16b connected to a fuse receptacle 22a are, in turn,

respectively connected to a power source (e.g., B+) and an electrical load 25 within the vehicle. Hence, the power terminal 16a and the load terminal 16b are spaced close together for each circuit routed through the fuse box 10. This close spacing can be disadvantageous due to excess heating that can occur at the terminals. Further, since all of the power and load terminals 16 are closely located to one another in the bottom portion 18 of the fuse box 10, the heating that occurs can become excessive, particularly in newer automobile electrical systems having higher load requirements.

Additionally, the standard automobile fuses known in the art (e.g., see Figure 2) are manufactured as singular devices. Fuses shipped to the end user (e.g., an automobile manufacturer) are typically packaged as singulated devices that are delivered in bulk or placed within a "tube", taped together or other similar packaging that is convenient for the end user when inserting the fuses into the above-described fuse boxes, for example. However, such packaging is costly and time intensive for the fuse manufacturer since the fuses must be individually separated and packaged.

Furthermore, fuse boxes known in the art (e.g., see Figure 1) are designed to receive individual fuses that must be individually inserted into the fuse box. Because fuses are individually placed in the fuse box, the number of manufacturing steps is increase, thereby also

increasing the complexity of placing and connecting the fuses in the fuse box when multiple fuses are required, for example.

Another issue with fuses boxes is size. As with any component used in a vehicle, size is increasingly a concern. Automobile manufacturers are constantly striving to reduce the size and weight of most automobile components. Fuse boxes, due to their current structure and the arrangement of the fuses and related components, create some unique issues in attempting to reduce the size of same.

Accordingly, there is a need for an improved fuse box and fuse arrangement.

#### SUMMARY OF THE INVENTION

The present invention provides improved fuse arrangements as well as improved fuse boxes.

In an embodiment of the invention, a fuse arrangement is provided having a wiring terminal with a plurality of discrete circuits extending therefrom. In addition, the arrangement includes a common bus assembly. At least one axial fuse is disposed between the wiring terminal and the common bus assembly such that the common bus assembly is electrically connected to the wiring terminal through the at least one fuse. The placement of an axial fuse between the common bus assembly supplying a voltage and the wiring terminal serves, in part, to diminish the heat generated in the arrangement

by allowing heat to more readily dissipate. In addition, the use of common bus assembly decreases the complexity of the fuse arrangement. Moreover, this arrangement allows one to design fuse boxes having a reduced size.

5           In another embodiment of the invention, a fuse array is constructed with a planar insulating substrate having two planar sides. A metallization pattern is disposed on at least one side of the substrate and comprises at least one fuse element. A protective coating is disposed  
10           on the sides of the substrate and covers at least a first portion of the metallization. The construction of one or more fuses on a planar substrate affords modularity in the fuse design and corresponding easier insertion and removal of fuses within a fuse block.

15           In another embodiment of the invention, a packaging apparatus for vehicle fuses includes a carrier strip having at least one rail comprised of a flexible material. In addition, a plurality of fuse assemblies are integrally connected to the at least one rail, but  
20           also configured to be separable from the rail by an end user. The carrier strip is capable of being rolled to form a package for shipping to the end user. The use of a carrier strip having integral fuse assemblies and the capacity to be rolled-up for shipping reduces  
25           manufacturing steps and costs for the fuse manufacturer. Additionally, since the fuse assemblies are configured to be separable from the rails of the carrier strip by

an end user, the ease with which the end user may place and connect fuses within a fuse box, for example, can be increased.

Accordingly, an advantage of the present invention is to provide an improved fuse arrangement for fuse boxes.

Another advantage of the present invention is to provide improved fuse boxes for vehicles.

Still further, an advantage of the present invention is to provide fuse boxes for vehicles having a reduced size.

Moreover, an advantage of the present invention is to provide for improved means for providing fuses to manufacturers of fuse boxes.

Additionally, an advantage of the present invention is to provide a fuse box arrangement that diminishes the heat generated.

Further, an advantage of the present invention is to provide a fuse arrangement that decreases the complexity of the assembly of a fuse box.

Another advantage of the present invention is to provide an improved method for manufacturing and constructing fuse boxes.

Another advantage of the present invention is to provide an improved fuse for use in vehicle fuse boxes.

Other objects and advantages of the invention will become apparent upon reading the following detailed



description and appended claims, and upon reference to the accompanying drawings.

**BRIEF DESCRIPTION OF THE DRAWINGS**

References made to the attached drawings, wherein  
5 elements having the same reference numeral designations represent like elements throughout and wherein:

Figure 1 is a perspective drawing illustrating a fuse box arrangement known in the art.

Figure 2 is a perspective view of a conventional  
10 radial-type fuse used in the fuse box shown in Figure 1.

Figure 3 is a sectional view of a fuse box arrangement according to an embodiment of the present invention.

Figure 4 is a section diagram illustrating a fuse  
15 box according to an alternative embodiment of the present invention.

Figure 5 is a section drawing of a fuse box according to yet another embodiment of the present invention.

Figure 6 is an illustration of a fuse array  
20 according to an embodiment of the present invention.

Figure 7 is a top section view of the fuse array shown in Figure 6.

Figure 8 is an end section view of the fuse array  
25 illustrated in Figure 6.

Figure 9 is a cut away view of the fuse array shown in Figure 6 illustrating a metallization pattern.

Figure 10 is an illustration of a fuse packaging arrangement for axial-type fuses according to an embodiment of the present invention.

5 Figure 11 is an illustration of a fuse packaging arrangement for radial-type fuses according to another embodiment of the present invention.

Figure 12 illustrates a small automobile fuse according to an embodiment of the present invention.

10 **DETAILED DESCRIPTION OF THE**  
**PRESENTLY PREFERRED EMBODIMENTS**

The present invention provides improved fuse arrangements and fuses boxes.

15 In part, the present invention provides a fuse box arrangement for a vehicle that diminishes the heat generated by typical fuse boxes that include closely spaced terminals due to both supply and load terminals being located on one side of a fuse box. Additionally, the present invention provides a fuse arrangement that decreases the complexity of assembly of a fuse box and  
20 also the placement and connection of the fuses. Moreover, the present invention provides an arrangement for packaging fuses that facilitates the ease of manufacturing as well as placement and connection of the fuses by an end user. Further, the present invention  
25 provides concepts and arrangements that allow one to design and manufacture fuse boxes having a reduced size.

Referring now to the figures, Figure 3 is a sectional view of an exemplary fuse box arrangement according to the present invention. The fuse box, shown generally at 40, includes a base portion 42 and a cover 44. In the embodiment illustrated, within the base portion 42, is a wiring harness 52 having a plurality of terminals 53 that connect with fuses (i.e., fuses 48<sub>1</sub>-48<sub>n</sub>). The wiring harness 52 is connected to a plurality of conductors 56 that supply current to loads within a vehicle containing the fuse box 40.

In the embodiment illustrated, the cover 44 includes an integral common bus terminal 46 that connects with each of the fuses 48 via the fuse terminals 49. The common bus terminal 46 is preferably connected to the positive terminal voltage B+ of the vehicle battery, shown connected at node 54.

In the exemplary embodiment, each of the fuses 48 is an axial-type fuse comprised of a fuse body 51 that encloses a fuse element 50. In addition, each of the fuses 48 has a pair of opposing terminals 49 connected to the fuse element 50 that extend outward from the fuse body 51 in opposing directions.

When the fuse box 40 is assembled, a terminal 49 of each of the fuses 48 is inserted into a receptacle 55 within the base 42 that connects to the terminals 53 within the wiring harness 52. Preferably, the receptacles 55 are of a female-type that receive a male-

type terminal 49 of the fuse 48. However, the receptacle 55 can also be constructed as a male-type plug that receives a female-type terminal 49 of the fuse 48.

5 The opposing terminal 49 connected to receptacle 55  
for each fuse 48 is connected to the common terminal bus  
46 having similar receptacles (not shown) to those  
receptacles 55 in the base 42. Since the common bus  
terminal 46 is integral with the cover 44 of the fuse box  
40, connection of the common bus terminal 46 is made with  
10 the terminals 49 of each of the fuses 48 when the cover  
44 is placed on or mated with the base 42. To accomplish  
this connection, the location of the common bus terminal  
46 within the cover 44 is placed such that it is directly  
vertical above the receptacles 55 within the base 42 when  
15 the cover 44 is mated with the base 42.

It will be appreciated that the singular common bus  
terminal 46 enables ease of connection of the voltage B+  
to a group or all of the fuses 48 within the fuse box 40.  
Additionally, this arrangement affords quick connection  
20 or disconnection of the fuses from the battery voltage  
B+. Moreover, the arrangement of the present embodiment  
creates separation of the voltage supply terminal (i.e.,  
the common bus terminal 46) from the terminals 53 that  
supply the loads within the vehicle. Thus, the heat  
25 generated at the terminals 49 of the fuses when current  
flows through the fuses 48 is more easily and efficiently  
dissipated since the two opposing terminals 49 are spaced

apart. This efficient heat dissipation allows the fuse box 40 to more easily be adapted for higher voltages and currents that may be utilized in the vehicle.

In an alternate embodiment, a fuse box 60 shown in Figure 4 illustrates a common bus terminal 62 that is separate from the cover 44 of the fuse box 60. Thus, the common bus terminal 62 of the present embodiment can be used to connect either all of the fuses 48 within the fuse box or a portion of the fuses 48 with the battery voltage B+. An advantage of this arrangement is that the fuses are not disconnected from the supply voltage B+ when the cover 44 of the fuse box 60 is removed from the base 42. A further advantage is that separate common bus terminals can be provided for select groups of fuses 48. Thus, more than one common bus terminal may be provided within the fuse box 60.

Figure 5 illustrates yet another alternate embodiment of the present invention wherein the wiring harness 52 is located within the cover 44 of a fuse box, shown generally at 70. In this embodiment, the wiring harness 52 may either be attached to the cover 44, similar to the common bus terminal 46 shown in Figure 3 or separate from the cover 44, similar to the common bus terminal 62 in the embodiment of Figure 4. The fuse box 70 of Figure 5 also includes a common bus terminal 72 within the base portion 42 of the fuse box that is, in turn, connected to the battery supply voltage B+.

As discussed above with respect to Figure 3, the separation of the common bus terminal supplying voltage B+ and the wiring harness 52 affords improved thermal dissipation for a vehicle fuse box. Moreover, as will be apparent, such a construction may allow one to design and provide fuse boxes for vehicles having a reduced size.

To further improve the thermal properties of the fuse box, in each of the embodiments of Figures 3 through 5, the fuse box housing may be constructed of a thermally conductive material that further facilitates removal of heat from the fuses and other wiring and devices contained within the fuse box. In an embodiment, the fuse box may include, in its interior, thermally conductive materials to facilitate the diffusion of heat that is generated.

Figure 6 illustrates another embodiment of the present invention for positioning fuses on a rigid substrate. In particular, Figure 6 illustrates a fuse array 80, preferably for use in a vehicle. The array includes an insulative substrate 92 constructed of ceramic, plastic or some other similar rigid insulator. Preferably, the substrate 92 is a thin elongate rectangle having two planar sides 83 as shown in an end view of the fuse array in Figure 8.

Disposed on both sides of the substrate 92 is a metallization pattern 88 that is formed to construct the

fuse elements 90. Associated with each fuse element 90 is a contact portion 86 that contacts with fuse block terminals (not shown); the block terminals, in turn, are connected to discreet circuits supplying loads within the vehicle. The metallization pattern 88 also includes a common bus terminal 91 on a portion of the substrate 92 having contact portions 84 that connect to a supply battery voltage B+. Preferably, the patterned fuse elements 90 on one planar side 83 of the substrate 92 are offset from those fuse elements disposed on the other side of the substrate 92. Illustrative of this arrangement, Figure 9 shows a fuse element 90' that is disposed on the side of the substrate opposite to fuse elements 90 and also offset.

Also included in the fuse array are protective coatings 82 disposed on each planar side 83 of the fuse array 80 as shown in Figures 6 through 8. These protective coatings 82 are constructed of an insulative material enabling the fuse array to be held by a user during insertion in or removal from a fuse box.

Of particular note, Figure 9 illustrates that the fuse elements 90 are constructed as axial-type fuses. Such construction enables the common terminal bus 91 to supply voltage on the top portion of the substrate 92. This is advantageous in that, as discussed previously, separation of the load supplying terminals 86 of the fuses from the terminals connected to the voltage supply

terminal (i.e., 91) affords improved heat dissipation properties.

Also of particular note, the substrate 82 covers only a portion of each side 83 of the substrate 92. The portion of the substrate 92 that is not covered forms a contact ledge 85 formed of the exposed metallization pattern (i.e., common bus terminal contacts 84 and fuse element contacts 86) that connect to terminals within a fuse box. Thus, the receiving fuse box (not shown) contains a slot having a number of contacts corresponding to the number of contacts on the fuse array 80, wherein the contact ledge portion 85 fits into the slot within the fuse box. The arrangement may also be advantageous in that a plural number of fuses can be connected and disconnected easily and quickly.

Figure 10 illustrates an embodiment of the present invention for packaging and/or providing to an end user fuses that are used within a vehicle fuse box. Specifically, Figure 10 illustrates a carrier strip 100 that includes a plurality of fuse assemblies 102, each fuse assembly 102 having a housing 104 and a fuse element 106 contained within the housing 104. In the particular embodiment illustrated in Figure 10, the carrier strip 100 includes two parallel rails 110 and 112 that respectively connect with terminals 107 within the fuse assembly 102. The parallel rails 110 and 112 further include indexing holes 108 that index the location of



each particular fuse assembly 102.

When constructed, the carrier strip 100 is integrally connected with each of the fuse assemblies 102. That is, the carrier strip 100, including the fuse assemblies 102, is constructed of one sheet of material preferably copper, zinc or other suitable metal for fuse construction. Furthermore, the carrier strip 100, being constructed from a thin metal sheet made of copper or zinc, has a high degree of flexibility. Thus, the carrier strip 100 including the fuse assemblies 102 is capable of being rolled onto a spool for shipping purposes.

By providing the fuse assembly 102 rolled on a spool, a number of advantages are achieved. One advantage is ease of handling. The end user can merely unroll the carrier strip from the spool and then separate the fuse assemblies 102 from the rails 110 and 112 for use as individual fuses. Preferably, the fuse assemblies 102 are separated from the parallel rails 110 and 112 by cutting the metal at the regions indicated by reference number 109.

The above embodiment has been described with respect to axial-type fuse assemblies. However, as illustrated in Figure 11, the present invention can also be used for radial-type fuses 124 whose terminals 128 are connected to a single rail 120 of a carrier strip assembly.

With both embodiments of Figures 10 and 11, the carrier strip includes indexing holes 108 and 130 that can be further used by the end user to delineate the location of the fuse assemblies 102 or 122 when being separated from the carrier strip rail. For example, in an automated separation process that separates the fuse assemblies from the rails of the carrier strip, the indexing holes 108 or 130 can engage with pegs radially projecting from a drive wheel, the pegs spaced an angular distance around the circumference of the wheel at a distance that is equal to a linear distance "d" between the indexing holes in the rails of the carrier strip. Thus, when the drive wheel has rotated through an angular distance equal to "d", a cutting operation can be performed to separate the fuse assembly from the rails of the carrier strip.

The above described packaging apparatus is advantageous in that the fuse manufacturer can assemble multiple fuses from a single metal sheet. The fuses can be easily packaged for shipment to an end user by rolling a carrier strip having the multitude of fuses onto a spool or other similar device.

Figure 12 illustrates another embodiment of the present invention wherein the terminal spacing of small standard automotive blade fuses is reduced. In particular, Figure 12 illustrates a small automotive fuse according to the present invention including a housing

142 containing a fuse element (not shown). Extending out of the housing are a pair of blades 140 respectively connected to each side of the fuse element. Typically, in small automotive fuses known in the art, spacing "s" between the center point of the terminal blades 140 is set at an accepted industry standard. However, the spacing "s" is also constrained by the height "h" of the housing assembly.

The present invention includes a small automotive fuse 144 that reduces the spacing "s" between the terminal blades 140. In order to accomplish this reduction in spacing, the height "h" of the fuse housing 142 must be increased to accommodate for a reduction in the width "w" of the housing 142 due to the reduction of the spacing "s". That is, when the spacing "s" is reduced, the width of the housing "w" is reduced in order to have a corresponding reduction in the housing holding the blades 140. Accordingly, since the area within the housing 142 is reduced due to a reduction in the width "w", the height "h" of the housing 142 must be increased in order to regain the original area, which is necessary for the fuse element.

A purpose of the invention shown in Figure 12 is to reduce the spacing "s" between the terminal blades 140 to approximately 5.6 millimeters, for example, so that this fuse may only be inserted into a correspondingly sized fuse receptacle within an automobile fuse box.

Conversely, standard automobile fuses such as that shown in Figure 2, cannot be inserted into the reduced spacing receptacle in the fuse box that accommodates the fuse shown in Figure 12. Accordingly, the circuit connected to the small fuse 144 with reduced terminal spacing can be connected to a circuit having a different voltage supply from the standard 12 volt supply used in most automobile systems.

Especially advantageous is the use of the small fuse 144 with higher voltage systems within a vehicle. Hence, standard 12 volt rated fuses could not be inserted into the fuse box receptacle intended for the higher voltage small fuse 144 having reduced spacing. This thereby acts as a safeguard against improper and dangerous insertion of fuses into receptacles having voltages exceeding their rating.

It should be understood that various changes and modifications to the presently preferred embodiments described herein will be apparent to those skilled in the art. Such changes and modifications may be made without departing from the spirit and scope of the present invention and without diminishing its attendant advantages. It is, therefore, intended that such changes and modifications be covered by the appended claims.

**WHAT IS CLAIMED IS:**

1. A fuse arrangement for a vehicle comprising:  
a wiring terminal having a plurality of discrete  
circuits extending therefrom;

5 a common bus assembly; and

at least one axial fuse disposed between at least  
one of the plurality of circuits in the wiring terminal  
and the common bus assembly for electrically connecting  
the common bus assembly to at least one of the plurality  
10 of discrete circuits through the at least one axial fuse.

2. The fuse arrangement of Claim 1, further  
comprising:

a housing having a cover and a base portion, wherein  
15 the wiring terminal is contained within the base portion  
and the common bus assembly is contained within the cover  
of the fuse box.

3. The fuse arrangement of Claim 1, wherein the  
20 axial fuse further comprises first and second male  
terminal portions that are configured to mate with  
respective female portions within the wiring terminal and  
common bus assembly.

25 4. The fuse arrangement of Claim 1, wherein the  
axial fuse further comprises first and second female  
terminal portions that are configured to mate with

respective male portions within the wiring terminal and common bus assembly.

5           5.    The fuse arrangement of Claim 1, wherein the common bus assembly further comprises a common bus having a plurality of fuse terminal connections extending therefrom, the common bus and plurality of fuse terminal connections being disposed in a single enclosure.

10           6.    The fuse arrangement of Claim 1, wherein the wiring terminal includes a plurality of discrete circuits that are, in turn, connected to respective electrical loads respectively protected by the at least one fuse disposed between the wiring terminal and the common bus  
15 fitting.

20           7.    The fuse arrangement of Claim 2, wherein the housing is constructed, at least in part, of a thermally conductive material facilitating the removal of heat from elements contained within the fuse box.

8.    An apparatus for packaging vehicle fuses comprising:

25           a carrier strip having at least one rail comprised of a flexible material;

          a plurality of fuse assemblies integrally connected to the at least one rail, each of the plurality of fuse

assemblies configured to be removable from the rail and configured to be separable from the at least one rail for individual use by an end user; and

5 wherein the carrier strip is so constructed and arranged that it can be rolled to form a package for shipping to the end user.

9. The apparatus of Claim 8, wherein:  
the carrier strip includes two parallel rails and  
10 each of the plurality of fuse assemblies is integrally connected between the parallel rails.

10. The apparatus of Claim 8, wherein the plurality of fuse assemblies is comprised of axial-type fuses.

15 11. The apparatus of Claim 8, wherein each of the plurality of fuse assemblies is comprised of radial-type fuses.

20 12. The apparatus of Claim 8, wherein the carrier strip contains a plurality of indexing apertures, each of the indexing apertures associated with a corresponding fuse assembly, wherein the indexing apertures facilitate the removal of the fuse assemblies from the carrier strip  
25 and separation of the fuse assemblies from each other by the end user.

13. A vehicle fuse array assembly comprising:

a planar, electrically insulating substrate having at least two planar sides;

5 a metallization pattern disposed on at least one side of the planar substrate, the metallization pattern comprising at least one fuse element; and

10 a protective coating disposed on at least a respective portion of at least one side of the planar substrate and covering at least a first portion of the metallization pattern.

15 14. The vehicle fuse array assembly of Claim 13, wherein a second portion of the metallization pattern is not covered by the protective coating, the second portion configured as a contact portion of the assembly.

20 15. The vehicle fuse array assembly of Claim 13, wherein the second portion of the metallization pattern comprises at least one terminal of the at least one fuse element.

25 16. The vehicle fuse array assembly of Claim 13, wherein the at least one fuse element is an axial-type fuse.

17. The vehicle fuse array assembly of Claim 13, wherein the metallization pattern further comprises a



common terminal that is electrically connected to a terminal of the at least one fuse element.

18. The vehicle fuse array assembly of Claim 13,  
5 wherein the fuse array assembly is configured to mate with a terminal arrangement of a vehicle fuse box.

19. A fuse box arrangement for a vehicle comprising:  
10 a fuse box having a base and a cover;  
a common bus terminal within the fuse box, the common bus terminal connected to a voltage supply;  
a plurality of wire terminals within the fuse box, each of the plurality of wire terminals connected to a  
15 discrete circuit; and  
a fuse array having at least one axial fuse arranged between the base and the cover of the fuse box, the axial fuse electrically connecting the common bus terminal with the discrete circuit.

20. The fuse box arrangement of Claim 19, wherein the common bus terminal is affixed to the cover.

21. The fuse box arrangement of Claim 19, wherein  
25 the plurality of wire terminals is affixed to the base.

22. The fuse box arrangement of Claim 19, wherein the common bus terminal is affixed to the base.

23. The fuse box arrangement of Claim 19, wherein  
5 the plurality of wire terminals is affixed to the cover.

24. The fuse box arrangement of Claim 19, wherein the fuse array further comprises:

a planar, electrically insulating substrate having  
10 at least two planar sides;

a metallization pattern disposed on at least one side of the planar substrate, the metallization pattern comprising at least one fuse element;

a protective coating disposed on at least a  
15 respective portion of at least one side of the planar substrate and covering at least a first portion of the metallization pattern; and

a second portion of the metallization pattern that is not covered by the protective coating, the second  
20 portion configured as a contact portion of the fuse array.

25. The fuse box arrangement of Claim 19, wherein the common bus terminal further comprises a plurality of  
25 contact terminals that are configured to connect to first terminals of each of the plurality of fuses within the fuse array, wherein the common bus terminal is configured

to simultaneously connect all of the contact terminal therein with the first terminals of each of the fuses when connecting the common bus terminal to the first terminals.

5

26. A method for manufacturing vehicle fuse boxes having a reduced size comprising the steps of:

separating the location of a bus assembly and a wiring harness so they are located on opposite sides of a fuse box including a top and a bottom; and

10

electrically connecting the bus assembly and a circuit of the wiring harness using an axial fuse that extends between the top and the bottom of the fuse box.

15

27. The method of Claim 26 including the step of constructing the housing of the fuse box, at least in part, of a thermally conductive material to improve the dissipation of heat that is generated.

**ABSTRACT**

A fuse arrangement for use in a vehicle is provided having a configuration wherein a common bus terminal connected to a voltage supply is connected to terminals  
5 of one or more axial fuses. The other fuse terminals are, in turn, connected to a wiring harness that is located on an opposite side of the fuse box from the common bus terminal in a base of a fuse box. Additionally, the present invention includes a fuse array  
10 including a planar substrate with fuses constructed on the substrate by film metallization. Furthermore, the invention includes a carrier strip used for packaging automotive fuses that is made of a flexible material capable of being rolled into a package for shipping to  
15 an end user. The invention also includes a mini fuse having reduced terminal spacing for use in vehicles with mixed voltage systems wherein the reduced terminal spacing fuse is used for a particular voltage.

**FIG. 1**  
(PRIOR ART)

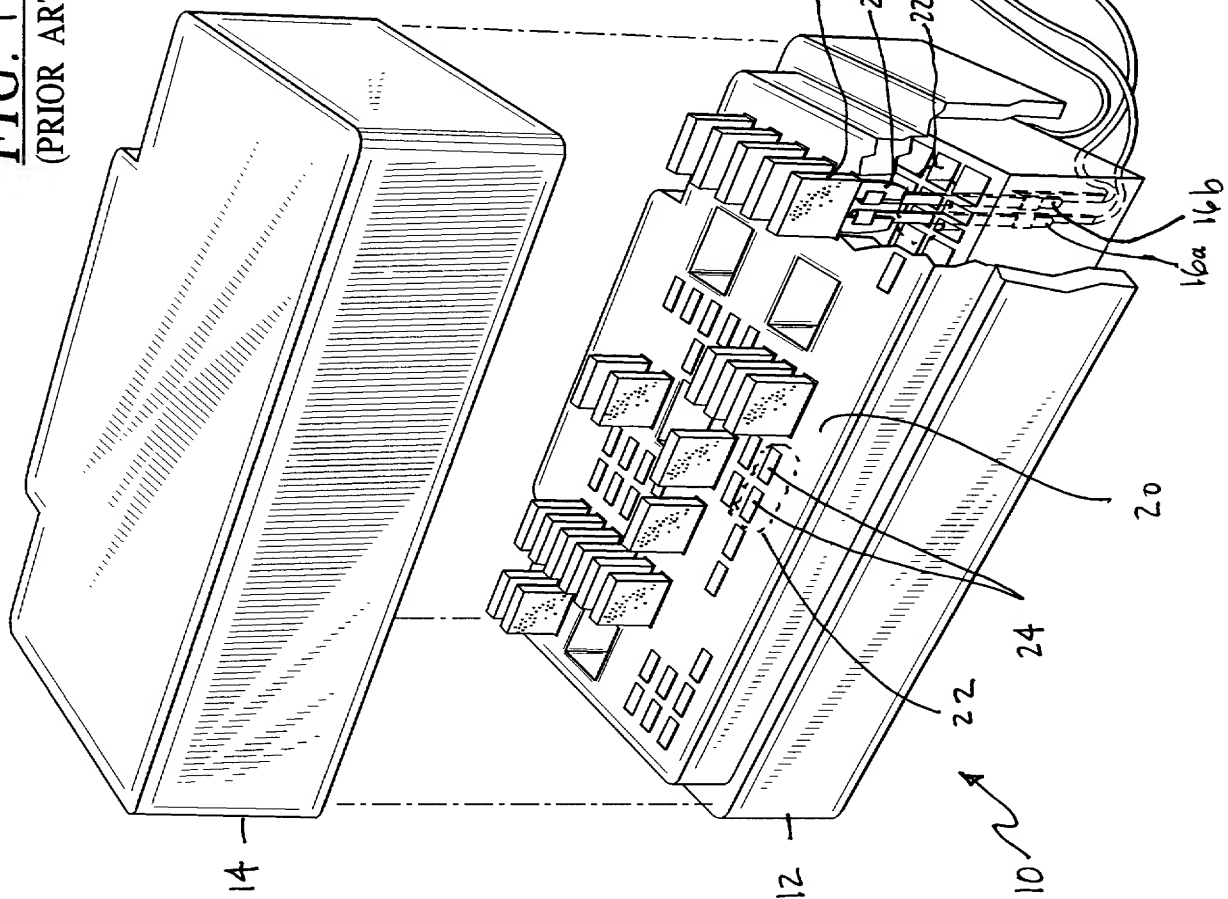
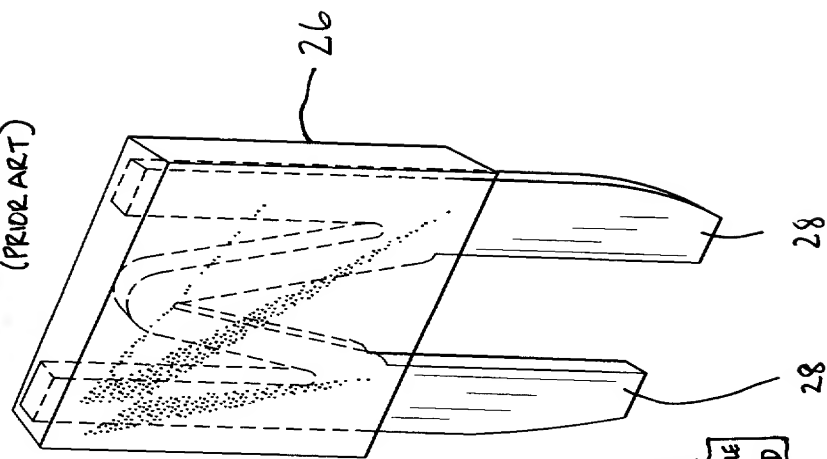
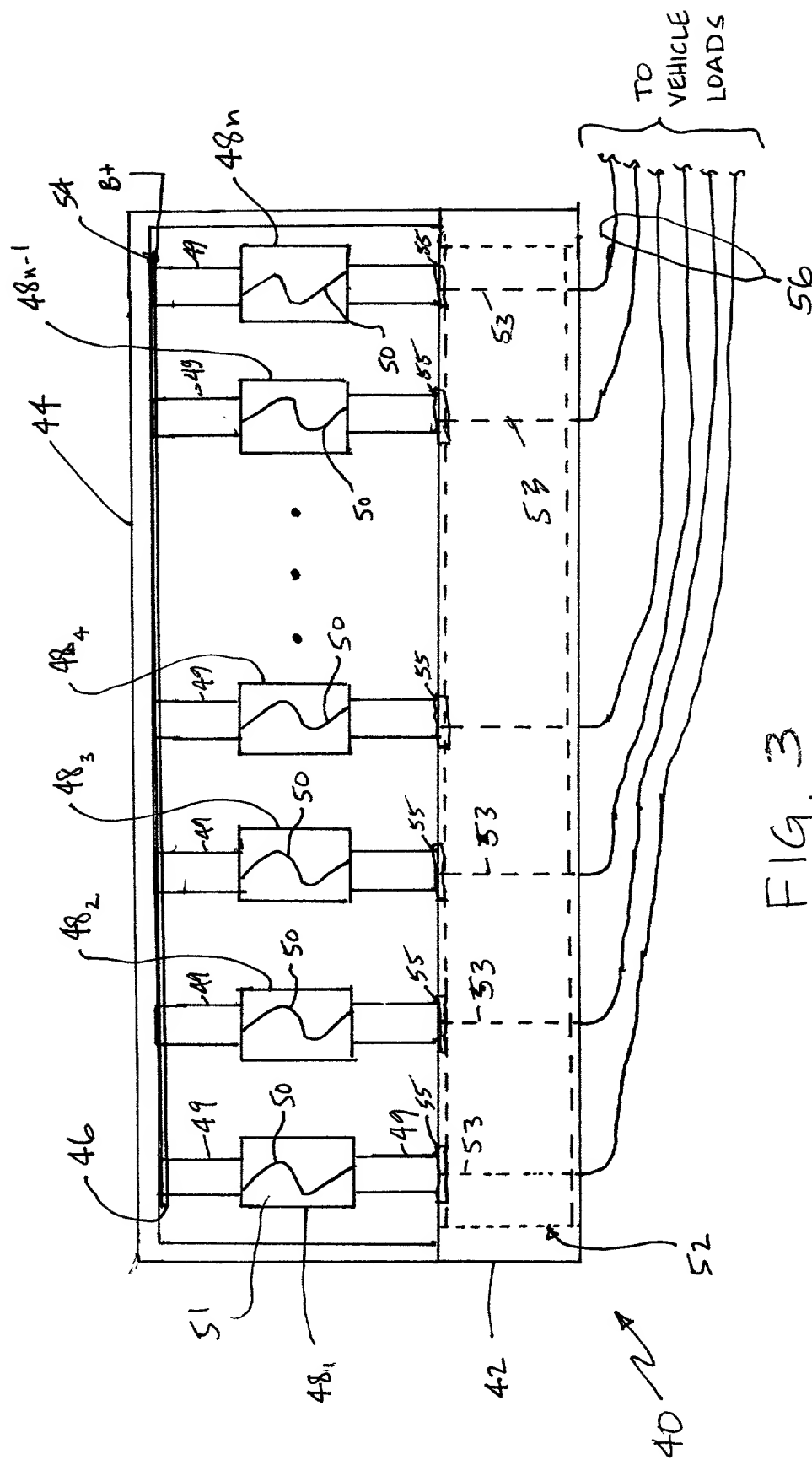


FIG. 2  
(PRIOR ART)





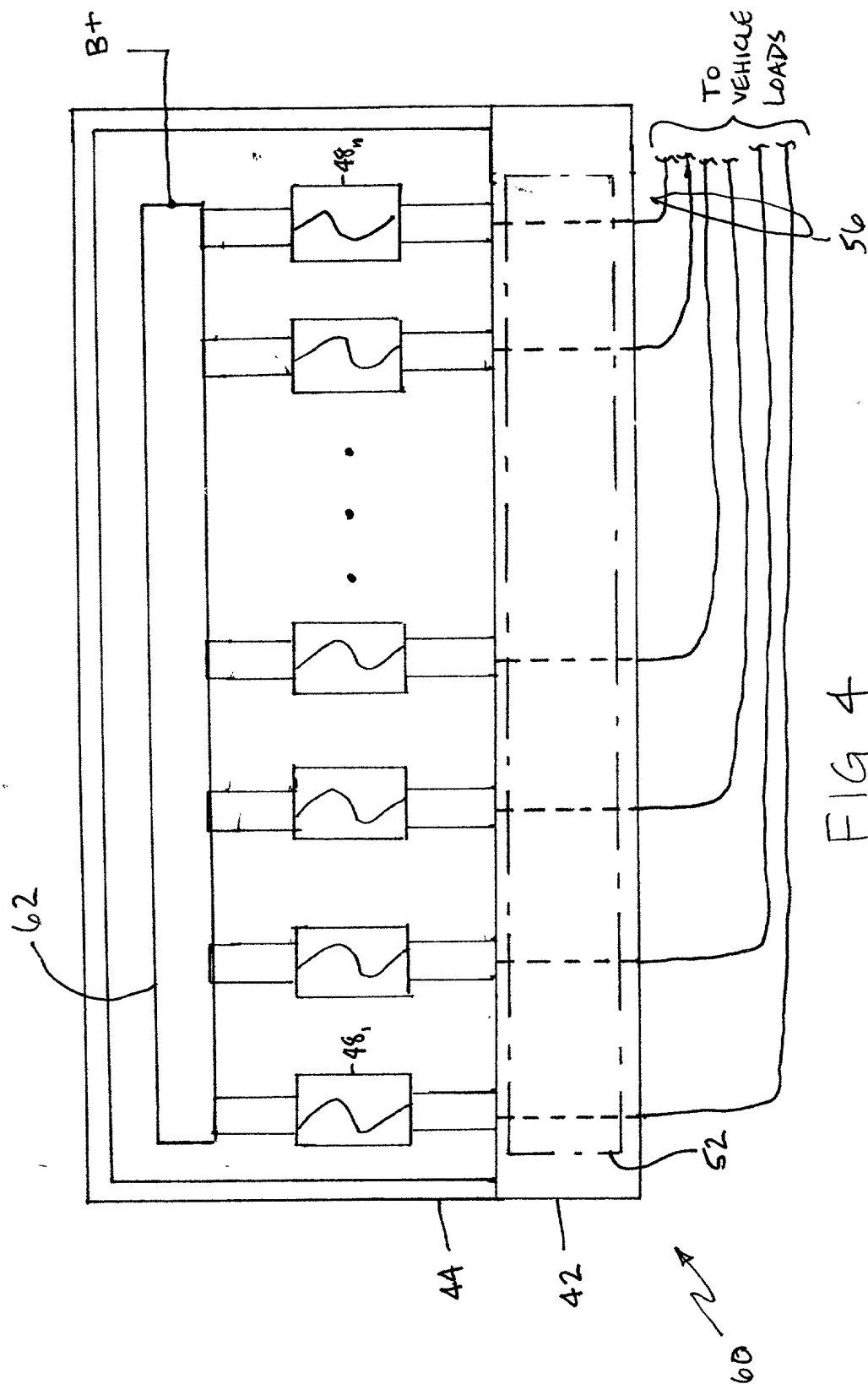


FIG. 4

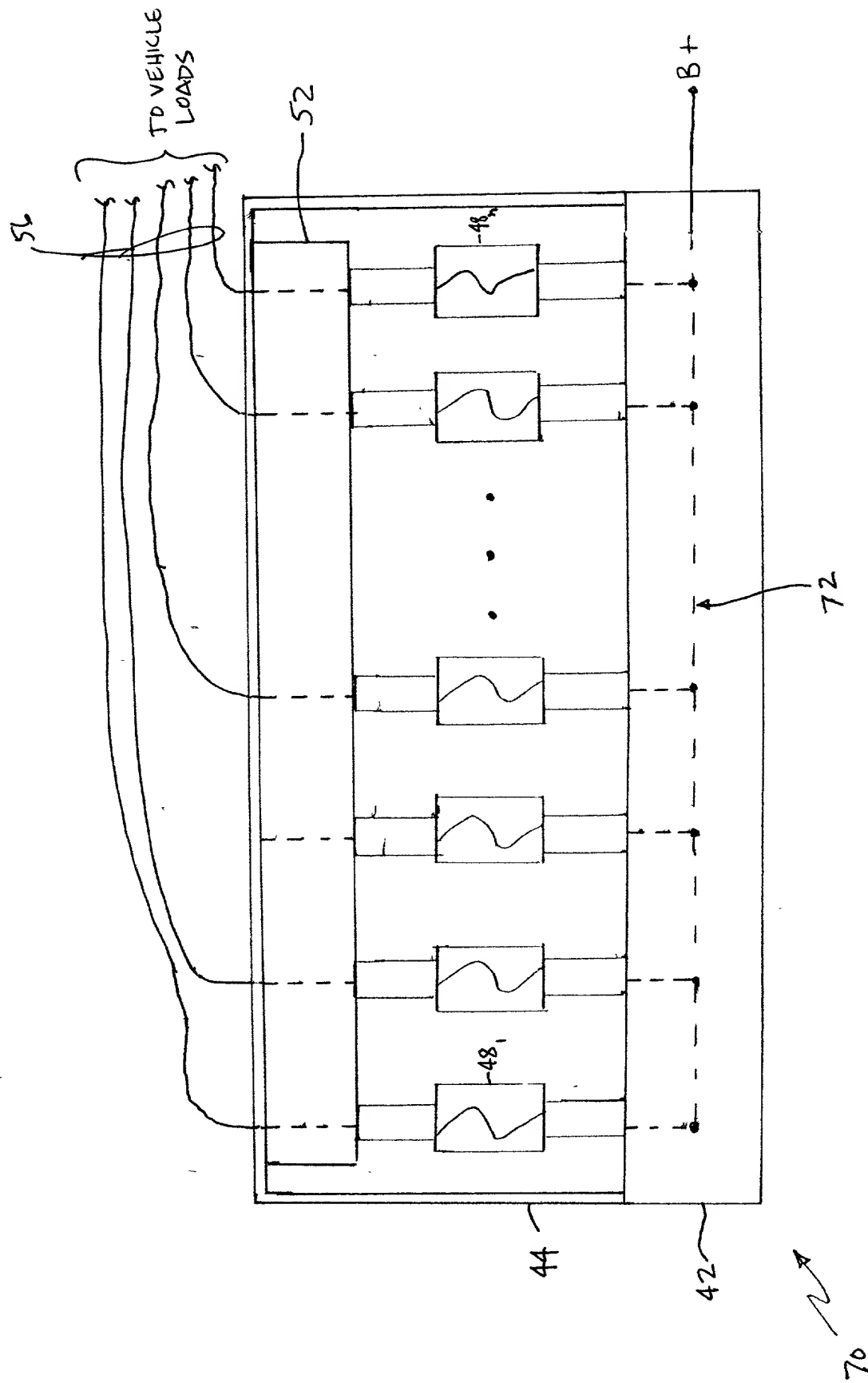
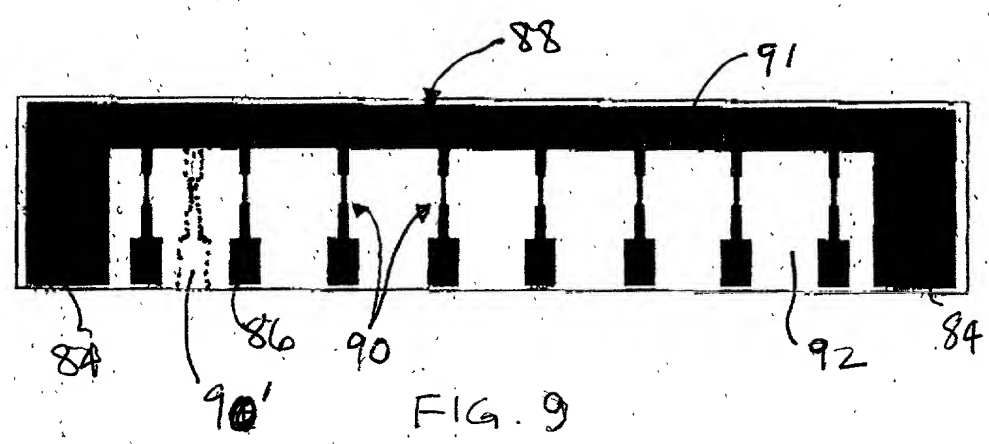
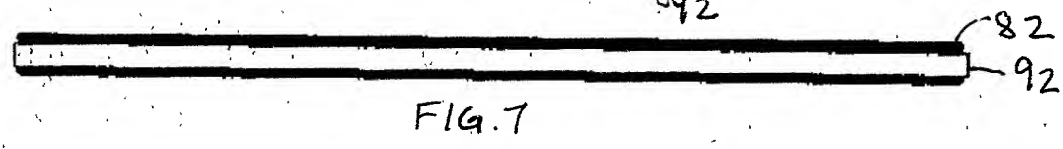
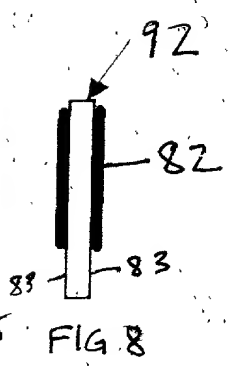
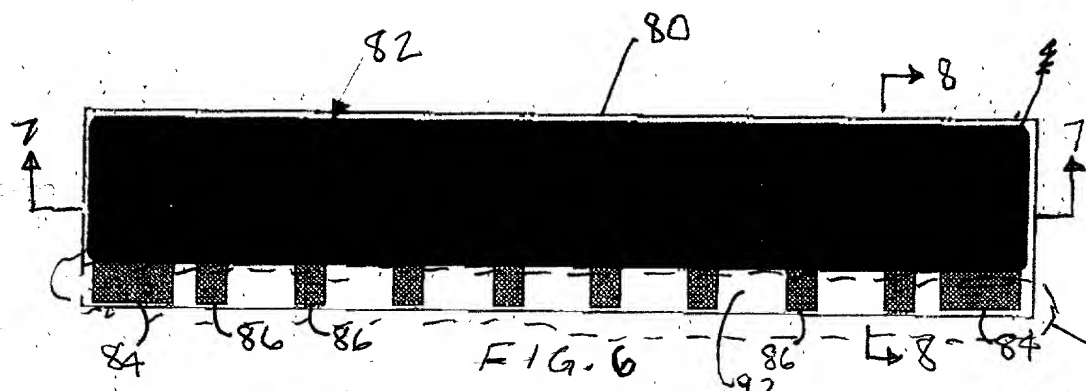


FIG. 5





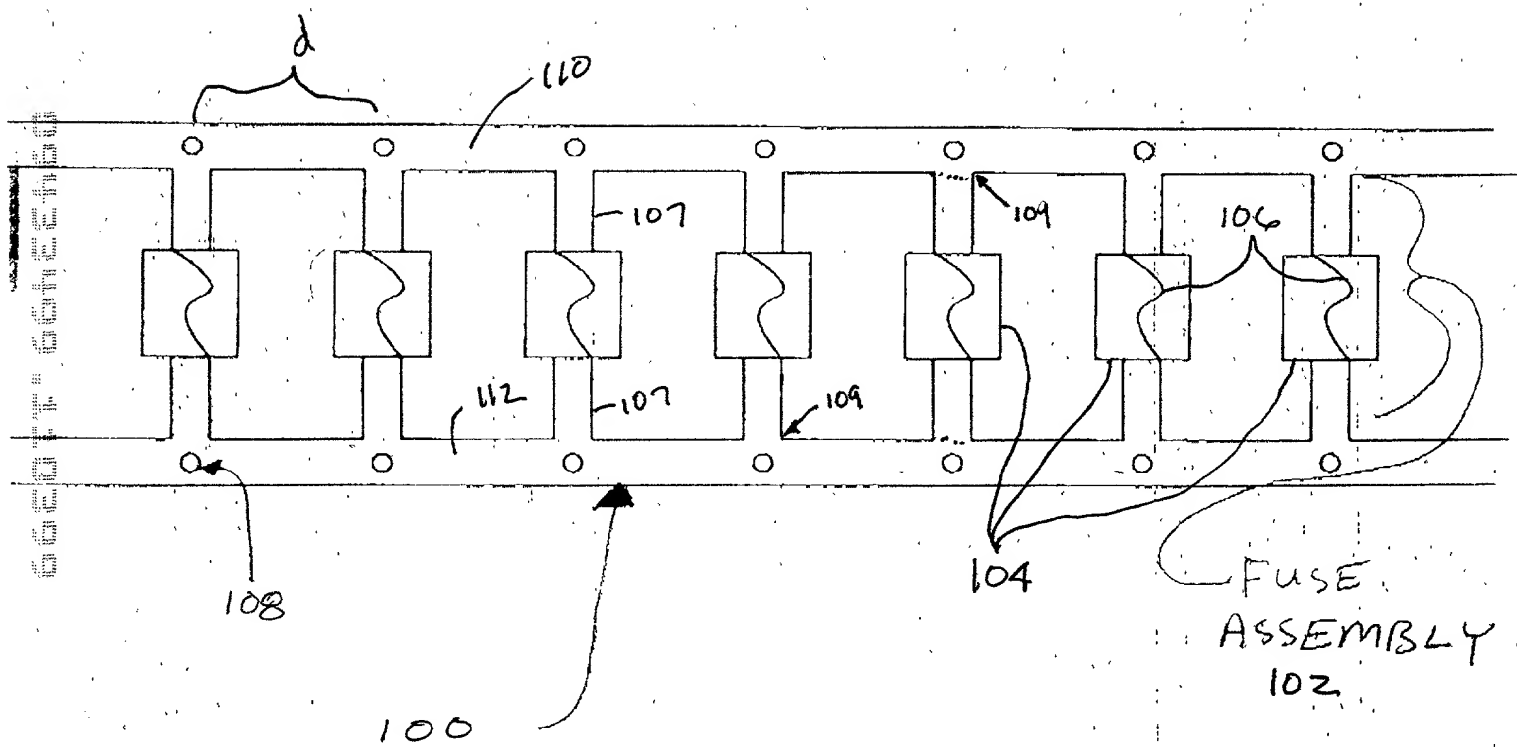


FIG. 10

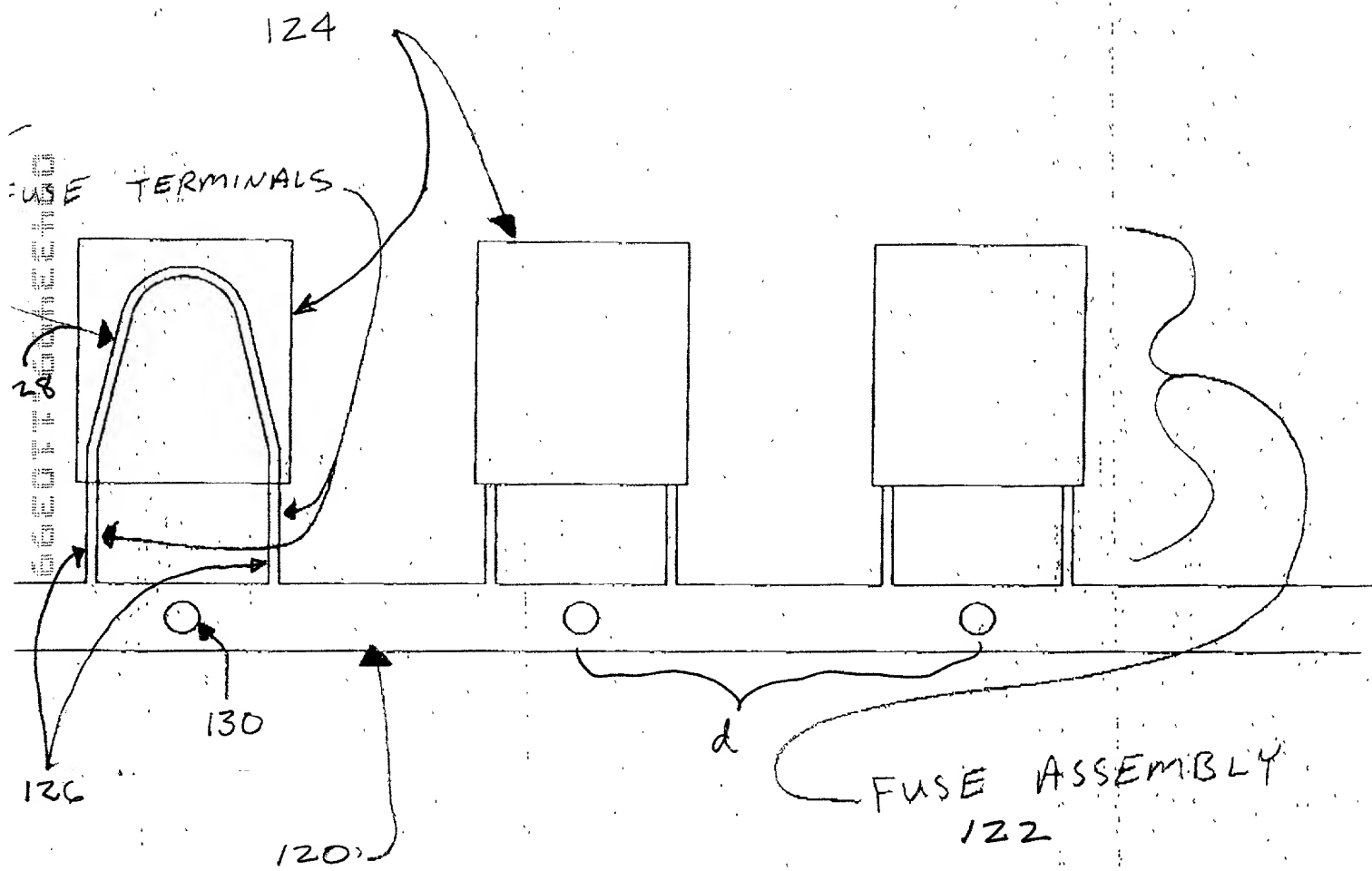


FIG. 11

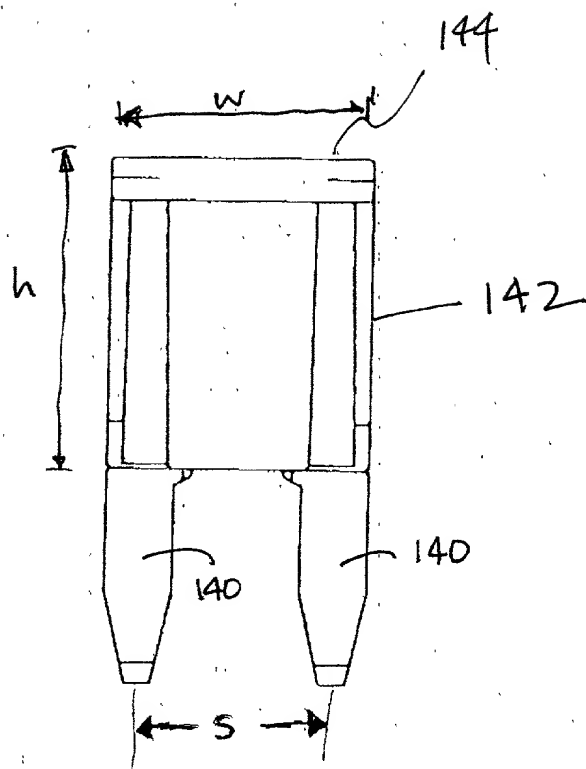


FIG. 12

## DECLARATION AND POWER OF ATTORNEY

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

### FUSE ARRANGEMENTS AND FUSE BOXES FOR A VEHICLE

Case No. P99,2275, the specification of which

(check one) X is attached hereto.  
     was filed on \_\_\_\_\_, as  
Application Serial No. \_\_\_\_\_  
and was amended on \_\_\_\_\_.  
(if applicable)

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims as amended by any amendment referred to above.

I acknowledge the duty to disclose to the United States Patent Office all information which is known to me to be material to the patentability of this application in accordance with Title 37, Code of Federal Regulations, 1.56.<sup>1</sup>

I do not know and do not believe this invention was ever known or used in the United States of America before my or our invention thereof, or patented or described in any printed publication in any country before my or our invention thereof or more than one year prior to this application, that the same was not in public use or on sale in the United States of America more than one year prior to this application, and I believe that the invention has not been patented or made the subject of an inventor's certificate issued before the date of this application in any country foreign to the United States of America on an application filed by me or my legal representatives or assigns more than twelve months prior to this application, and that no application for patent or inventor's certificate on this invention has been filed in any country foreign to the United States of America prior to this application by me or my legal representatives or assigns, except as identified below:

I hereby claim foreign priority benefits under Title 35, United States Code, 119 of any foreign application(s) for patent or inventor's certificate listed below

Prior Foreign Application(s)

Number

Country

Date

and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the above listed application on which priority is claimed:

Prior Foreign Application(s)

Number

Country

Date

<sup>1</sup> (b) Under this section, information is material to patentability when it is not cumulative to information already of record or being made of record in the application, and

(1) It establishes, by itself or in combination with other information, a *prima facie* case of unpatentability of a claim; or

(2) It refutes, or is inconsistent with, a position the applicant takes in:

(i) Opposing an argument of unpatentability relied on by the Office, or

(ii) Asserting an argument of patentability.

A *prima facie* case of unpatentability is established when the information compels a conclusion that a claim is unpatentable under the preponderance of evidence, burden-of-proof standard, giving each term in the claim its broadest reasonable construction consistent with the specification, and before any consideration is given to evidence which may be submitted in an attempt to establish a contrary conclusion of patentability.

If no priority is claimed, I have identified all foreign patent applications filed prior to this application:

Prior Foreign Application(s)

Number

Country

Date

And I hereby appoint Messrs. John D. Simpson (Registration No. 19,842), Dennis A. Gross (24,410), Robert M. Barrett, (30,142) Steven H. Noll (28,982), Kevin W. Guynn (29,927), Robert M. Ward (26,517), Brett A. Valiquet (27,841), Edward A. Lehman (22,312), David R. Metzger (32,919), Todd S. Parkhurst (26,494), James D. Hobart (24,149), Melvin A. Robinson (31,870), John R. Garrett (27,888), Joseph P. Reagen (35,332), Michael R. Hull (35,902), Michael S. Leonard (37,557), William E. Vaughan (39,056), and Lewis T. Steadman (17,074) all members of the firm of Hill & Simpson, A Professional Corporation

Telephone: 312/876-0200

as my attorneys with full power of substitution and revocation, to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith and direct that all correspondence be forwarded to:

Hill & Simpson

A Professional Corporation

85th Floor Sears Tower, Chicago, Illinois 60606

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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Full name of ninth joint inventor,  
(if any) \_\_\_\_\_

Inventor's signature \_\_\_\_\_ Date \_\_\_\_\_  
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Citizenship \_\_\_\_\_  
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